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Systematic Review: Health-related Characteristics of Elderly Hospitalized Patients and Nursing Home Residents Associated with Short-term Mortality

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Abstract

Background—Studies have examined numerous risk factors for mortality in older persons, and a systematic review offers the opportunity to organize these factors into broader domains.

Objective—To identify the domains of health-related characteristics of older hospitalized patients and nursing home residents most strongly associated with short-term mortality.

Data Sources—Studies published in English in MEDLINE, Scopus, or Web of Science before August 1, 2010.

Study Selection—Prospective studies consisting of persons 65 years or older that evaluated the association between at least one health-related patient characteristic and mortality within one year in multivariable analysis.

Data Extraction and Synthesis—All health-related characteristics associated with mortality in multivariable analysis were extracted and categorized into domains. We noted the frequency, across individual studies, with which particular domains were associated with mortality in multivariable analysis.

Results—Thirty-three studies (28 studies involving hospitalized patients and 5 studies involving nursing home residents) reported a large number of characteristics associated with mortality,

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CONFLICTS OF INTEREST

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comprising seven domains: cognitive function, disease diagnosis, laboratory values, nutrition, physical function, pressure sores, and shortness of breath. Measures of physical function and nutrition were the domains most frequently associated with mortality up to one year for hospitalized patients and nursing home residents; measures of physical function, cognitive function, and nutrition were the domains most frequently associated with in-hospital mortality for hospitalized patients.

Conclusion—Among a large number of health-related characteristics of older persons shown to be associated with short-term mortality, measures of nutrition, physical function, and cognitive function were the domains of health most frequently associated with mortality. These domains provide easily measurable factors that may serve as helpful markers for patients at increased mortality risk.

Keywords

mortality risk; elderly; prognosis; nursing homes; hospitalized

INTRODUCTION

Patients and their families are faced with many difficult health care decisions in late life. Uncertainties about the appropriateness of aggressive care in both screening activities and medical interventions abound. Those involved in health care decisions need to have as much information as possible about mortality risk as they explore available options of care.

Attempts to aid in these decisions by quantifying life expectancy or mortality risk for elderly patients have met with limited practical success, for several reasons. Prognostic indices, in most cases, have modest overall accuracy,^{1,2} lack validation in diverse populations,^{2,3} have untested clinical effects,^{1,2} and contain varying combinations of factors that may not be readily measured in every clinical setting. Physicians have reported that they prefer to avoid specific estimates of prognosis with patients.^{4,5} This is consistent with evidence from the SUPPORT trial, in which the availability of more accurate prognostic information did not improve communication between physicians and patients.⁶ Furthermore, much higher proportions of patients have reported that they desire qualitative prognostic information as compared to those who desire quantitative prognostic information.⁷

While quantified prognostic estimates have been examined only in single cohorts, many factors associated with short-term (one year or less) mortality risk in older persons have been examined in multiple cohorts and different settings, but there have been limited attempts to organize and summarize these data. One review⁸ examined factors associated with a number of outcomes in older hospitalized patients, but their goal was to provide a system for measuring hospital case mix. They evaluated length of stay, discharge destination, and readmission rates in addition to mortality, and they combined in-hospital mortality and mortality up to 2 years following admission as outcomes in their analyses.

A systematic review has the potential to undertake a comprehensive listing of all known factors associated with mortality and to identify consistent patterns of association across studies. This information may then be used to identify broader categories of characteristics

associated with mortality. In this review, we chose to focus on health-related characteristics associated with mortality, which we defined as characteristics inherent to the patient that can change clinically over time. Thus, certain widely accepted risk factors for mortality such as demographic factors^{9–11} (e.g., advancing age and male gender) and living situation^{12–14} (e.g., social isolation) were not included. The goals of this systematic review were to identify health-related characteristics of older hospitalized patients and nursing home residents associated with short-term mortality and to classify these characteristics into larger domains.

METHODS

Data Sources and Searches

We performed an electronic literature search of all English articles published in MEDLINE (1948-), Scopus (1960-), or Web of Science (1899-) before August 1, 2010 to identify prospective cohort studies on factors associated with short-term mortality in elderly hospitalized patients and nursing home residents. Our MEDLINE search used a combination of “filters,” consisting of MeSH terms, subheadings, text words, and multi-purpose terms. The following filters were used: prognosis studies, mortality, predictors, age, hospitalized patients, and nursing home residents. Modified forms of the same filters were used for the Scopus and Web of Science searches (see Appendix Table 1 for search strategies).

Study Selection

We identified a total of 7,644 articles. Of these, 5,393 were excluded by title review, and the remaining 2,251 were reviewed in abstract form by two of the investigators independently. The 367 articles appearing to meet inclusion criteria, as presented below, based on abstract alone were then retrieved and examined in full text. Two investigators reviewed the articles to determine whether they met inclusion criteria, and consensus was achieved, resulting in a total of 32 articles. To ensure completeness, the reference lists of the 32 included articles were also reviewed (by title at least, and if necessary, by abstract and full text), resulting in one additional article (Figure 1).

Inclusion Criteria—Studies were included if their participants were hospitalized patients, long-stay nursing home residents, or nursing home residents with advanced dementia only, regardless of length of stay. Long-stay was defined as residing in the nursing home for at least 3 months, and was specified to avoid cohorts containing patients receiving short-term, or subacute, care. We included studies of persons age 65 years or older, or, if age range was not provided, studies with a population average age of 80 years. We included studies with a prospective cohort design, including studies that use chart or record review in a prospective fashion; studies that examine at least one health-related characteristic, meaning a characteristic inherent to the patient that can change clinically over time, and thus not involving elements of health care treatment, medical devices, living situation, or demographics; studies that measure mortality within a follow-up period of one year or less; and studies that contain multivariable analysis. The criterion of a follow-up period of one year or less was chosen based on an initial review of the literature, in which a considerable number of studies on mortality specified a follow-up period of one year. Since a substantial

proportion of articles involving hospitalized patients did not report the number of patients lost to follow-up, we did not designate completeness of mortality follow-up as an inclusion criterion.

We did not include studies that excluded patients possessing characteristics potentially associated with mortality. Specifically, we did not include studies of nursing home residents that excluded terminally ill persons, those receiving palliative care, or those with specific illnesses, medications, or nutritional requirements; and we did not include studies of hospitalized patients that excluded nursing home residents, the terminally ill, patients receiving palliative care, those with specific illnesses or abnormalities, those who died in the hospital, or those living outside a prescribed geographical area.

The final inclusion list contained 33 articles. These articles were separated into the following categories based on patient population and follow-up period: hospitalized patients with mortality up to one year following admission, hospitalized patients with in-hospital mortality, general nursing home residents with mortality up to one year, and nursing home residents with advanced dementia with mortality up to one year.

Data Extraction

From all studies fulfilling inclusion criteria, we generated a list of health-related characteristics associated with short-term mortality in multivariable analysis ($p < 0.05$) and organized them according to the categories of patient populations described above.

Data Synthesis and Analysis

In order to organize the health-related characteristics associated with mortality and allow for broader, more meaningful comparisons, all three investigators reached consensus in grouping these characteristics into larger domains. The heterogeneity of study populations, independent variables measured, and statistical methods precluded combining results in a meta-analysis. Instead, we summarized the existing literature in an analysis step by noting the frequency, across individual studies, with which particular domains were associated with mortality in multivariable analysis.

For the analysis, we first noted for every patient-related health characteristic whether an association was found in multivariable analysis. Next, we determined frequencies by dividing the number of times a characteristic was associated with mortality in multivariable analysis by the total number of times assessed. We then combined the frequencies for all characteristics within each domain to produce an overall calculation of the frequency with which a domain was associated with mortality in multivariable analysis out of the total number of times assessed (Table 2).

Some single studies contained more than one cohort, and some pairs of studies contained identical cohorts. For the data extraction step, we included all papers and all cohorts to ensure completeness in identifying all characteristics associated with mortality. For the analysis step, we limited the data included as follows: when studies consisted of both development and validation cohorts, data from the validation cohort was preferentially used, unless analyses were available only for the development cohort; and when studies were

found to contain identical or overlapping populations, a single study was chosen from among them on a case-by-case basis (see Table 1 for specific explanations).

RESULTS

Our literature search identified 33 articles^{9–41} that met the inclusion criteria (Table 1). Eighteen studies involved hospitalized patients with mortality up to one year, 13 studies involved hospitalized patients with in-hospital mortality, three studies involved general nursing home residents with mortality up to one year, and two studies involved nursing home residents with advanced dementia with mortality up to one year.

All health-related characteristics associated with short-term mortality in multivariable analysis are listed in Table 1. We classified the characteristics into seven domains: cognitive function, disease diagnosis, physical function, laboratory values, nutrition, pressure sores, and shortness of breath. Cognitive function included the diagnosis of dementia, various measures of cognitive performance, and delirium. Disease diagnosis included comorbidity scales, such as the Charlson Comorbidity Index, and various individual diseases. Nutrition included body mass index, weight loss, albumin level, deficits in food intake, and various nutritional assessment scales. Physical function included functional assessment scales, individual functional impairments, and a decline in functionality. Pressure sores included scales for pressure sore risk as well as the presence of pressure sores. One health-related characteristic that appeared in several studies involving nursing home residents, “unstable medical condition,” was excluded from our review because of its unclear meaning.

Frequency of association of characteristics with mortality across studies in multivariable analyses

The 33 studies that met inclusion criteria reported on data from 31 unique populations, so two studies were excluded from the analysis step (see Table 1 for details). Table 2 shows the frequency across studies with which each domain was associated with mortality in multivariable analysis. The results according to patient population category appear below.

Hospitalized patients: mortality up to one year following admission—Those domains that were most frequently associated with mortality in multivariable analysis were nutrition (86%) and physical function (67%). These domains were more frequently associated with mortality than cognitive function (50%), pressure sores (50%), laboratory values (50%), and disease diagnosis (35%).

Hospitalized patients: in-hospital mortality—In multivariable analysis, those domains most frequently associated with mortality were physical function (62%), cognitive function (50%), and nutrition (45%). These domains were more frequently associated with mortality than disease diagnosis (36%) and laboratory values (25%). Pressure sores were associated with mortality in multivariable analysis in the one study that assessed them.

General nursing home residents: mortality up to one year—In multivariable analysis, those domains most frequently associated with mortality were nutrition (100%), physical function (100%), and shortness of breath (100%). These domains were more

frequently associated with mortality than disease diagnosis (50%), cognitive function (0%), and pressure sores (0%).

Nursing home residents with advanced dementia: mortality up to one year—

Those domains frequently associated with mortality in multivariable analysis were shortness of breath (100%), physical function (64%), pressure sores (50%), and nutrition (44%). These domains were more frequently associated with mortality than disease diagnosis (10%) and cognitive function (0%).

DISCUSSION

This systematic review identified numerous health-related characteristics of hospitalized patients and nursing home residents significantly associated with short-term mortality. A large number of individual characteristics were assessed in the studies included in the review. These characteristics, however, could be grouped into a smaller number of clinically meaningful domains: cognitive function, disease diagnosis, laboratory values, nutrition, physical function, pressure sores, and shortness of breath.

In studies of hospitalized patients, the domains associated with mortality in multivariable analysis in the highest proportions of studies were nutrition and physical function for mortality up to one year, and physical function, cognitive function, and nutrition for in-hospital mortality. Disease diagnosis and laboratory values were associated with mortality in multivariable analysis in lower proportions of studies, and pressure sores were assessed in too few studies to compare with the other domains. In studies of nursing home residents, physical function and nutrition were associated with mortality in multivariable analysis in the highest proportion of studies. Disease diagnosis was associated with mortality in multivariable analysis in a lower proportion of studies, cognitive function was not associated with mortality in multivariable analysis in any studies, and pressure sores and shortness of breath were assessed in too few studies to compare with the other domains.

The identification of domains in this review may address some of the limitations of prognostic indices pertaining to their use in clinical care. Rather than being developed only in specific populations, these domains were the result of a summary of data from studies containing a variety of populations. Second, they may be more acceptable to physicians than quantified prognostic estimates, for which physicians have expressed misgivings.^{4,5} Third, they can be easily evaluated in any clinical setting and do not necessarily involve calculations or specific laboratory measurements. A typical geriatric assessment would provide information about these domains,⁴² and regularly involves standardized tools to assess them. However, physicians often do not assess these domains for elderly patients, as evidenced by the substantial lack of physicians' evaluation of functional and nutritional status in studies involving the primary care⁴³ and hospital⁴⁴ settings.

Our domain-based analysis offers advantages to clinicians, their patients and families. Although it lacks the quantification of prognostic indices, it offers several advantages over prognostic indices as outlined above. Given the consistency of our findings, physicians can have confidence in the validity of the association with mortality of several domains of health

for older individuals. Thus, these domains of risk can be referred to in clinical practice with great certainty. Furthermore, they are a response to prior research indicating that qualitative prognostic information may be more acceptable to both physicians^{4,5} and patients.⁷ The identification of these domains allows physicians to easily recognize patients at increased mortality risk without attempting precision regarding that risk. A challenge for future research is to determine whether qualitative prognostic information is sufficient in the clinical setting to prompt re-evaluation of the benefits and harms of such care options as screening, prevention, and medically aggressive interventions.

Our review also identified domains of health that show some promise in their association with mortality, but have been examined in only a few studies. These domains, including pressure sores and shortness of breath, should be assessed in future studies seeking to identify factors associated with short-term mortality in elderly persons.

Notably, several seminal studies on mortality risk for hospitalized patients and nursing home residents were not appropriate for this review either because the study population included non-elderly persons or because the follow-up period was longer than our specified limit of 1 year. The SUPPORT prognostic model was developed in a population of adults 18 years or older with severe illness,^{45,46} and to our knowledge, the model was never tested in a cohort of elderly patients. While the HELP prognostic model was developed in a cohort of persons 80 years or older, the follow-up period was 2 years.⁴⁷ The Charlson comorbidity index, while developed and validated in non-elderly populations,⁴⁸ was assessed in several cohort studies included in this review.^{17,32,33,36} The MDS-CHESS scale for nursing home residents had a 3-year follow-up and included non-elderly persons.⁴⁹ Finally, the study from which the MDS Mortality Risk Index was developed did not specifically exclude short-term nursing home residents.⁵⁰

One limitation to this study is the heterogeneity of study cohorts. While this issue precluded a meta-analysis, we were still able to limit the heterogeneity of the data by defining strict inclusion criteria for study populations. Another limitation involved domain classification for risk factors that were applicable to more than one domain. We tended to preferentially classify such risk factors into conceptual domains over non-conceptual domains (e.g., albumin as measure of nutrition rather than laboratory value, dementia as measure of cognition rather than disease diagnosis), thus potentially biasing the results in favor of conceptual domains. Our analysis has certain limitations, including the lack of adjustment for differences in sample sizes across studies, the treatment of various factors within each domain as equally representative of that domain, and the lack of consistency across the original studies in terms of which risk factors and how many risk factors were studied. However, our approach stays true to the data, requiring few assumptions, and allows for a clinically meaningful synthesis while maintaining the original study results, with individual risk factors corresponding to each domain listed in Table 1. Although we could not assess loss to follow-up for a substantial proportion of studies involving hospitalized patients, we noted that all studies involving nursing home residents and all studies involving hospitalized patients with an outcome of in-hospital mortality had no patients lost to follow-up.

In summary, this review identified a number of domains of health associated with short-term mortality in the elderly. Of these domains, physical function and nutrition were most frequently associated with mortality up to one year in multivariable analyses for studies involving hospitalized patients and studies involving nursing home residents; physical function, cognitive function, and nutrition were most frequently associated with in-hospital mortality for studies involving hospitalized patients. Patients with a decline in one or more of these domains are at an increased mortality risk. Knowledge of this increased risk should be shared with patients and their families, as this information should be of value to them as they consider available care options.

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	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		x		x		x		
Grants/Funds		x		x		x		
Honoraria		x		x		x		
Speaker Forum		x		x		x		
Consultant		x		x		x		
Stocks		x		x		x		
Royalties		x		x		x		
Expert Testimony		x		x		x		
Board Member		x		x		x		
Patents		x		x		x		
Personal Relationship		x		x		x		

* Authors can be listed by abbreviations of their names

For “yes”, provide a brief explanation: _____

Sponsor’s Role: Indicate sponsor’s role in the design, methods, subject recruitment, data collections, analysis and preparation of paper. If there is no sponsor, indicate “none”.

None

Appendix Table 1. Literature search strategies for MEDLINE, Scopus, and Web of Science

MEDLINE Search Strategy

Prognosis studies filter

1. incidence/

2. exp mortality/
3. Follow-Up Studies/
4. mortality.fs.
5. prognos:.tw.
6. predict:.tw.
7. course.tw.
8. outcome:.tw.
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8

Predictors filter

1. risk:.mp.
2. assess:.mp.
3. predict:.mp.
4. factor:.mp.
5. screen:.mp.
6. probability:.mp.
7. exp risk/
8. 1 or 2 or 3 or 4 or 5 or 6 or 7

Mortality filter

1. exp mortality/
2. exp death/
3. exp survival analysis/
4. Life Expectancy/
5. mortality.fs.
6. death.mp.
7. survival.mp.
8. mortality.mp.
9. die:.mp.
10. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9

Age filter

1. exp aged/

Prognosis study filter and Mortality filter and Predictors filter and Age filter = Combo filter
 Combo filter was then combined with the hospitalized patients filter and with the nursing home residents filter in separate searches.

Hospitalized patients filter

1. hospital:.ti. and (elder: or old: or geriatric:).mp
2. (elder: adj2 hospitali#ed).mp
3. (old: adj2 hospitali#ed).mp
4. (geriatric: adj2 ward:).mp.
5. (geriatric: adj2 unit:).mp.
6. intensive care.ti. and (elder: or old: or geriatric:).mp.
7. inpatient:.ti. and (elder: or old: or geriatric:).mp.
8. geriatric: hospital:).mp.
9. ICU.ti. and (elder: or old: or geriatric:).mp.
10. intermediate care.ti. and (elder: or old: or geriatric:).mp.
11. (ward or wards).ti. and (elder: or old: or geriatric:).mp.
12. ((acute: adj2 hospital:) and (elder: or old: or geriatric:)).mp.
13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12

Nursing home residents filter

1. exp Residential Facilities/
2. Long-Term Care/
3. Institutionalization/
4. nursing home:.ti.
5. long-term care.ti.
6. extended care.ti.
7. 1 or 2 or 3 or 4 or 5 or 6

Scopus and Web of Science Search Strategy

Prognosis studies filter

mortality OR “follow up” OR outcome OR outcomes OR prognosis OR prognoses OR
 predict OR predicts OR predictor OR predictors

Mortality filter

mortality OR death OR “life expectancy” OR survival OR “survival analysis” OR “survival analyses” OR die*

Predictors filter

risk OR risks OR screen* OR factor OR factors OR predict OR predicts OR predictor OR predictors

Age filter

elder OR elders OR elderly OR old OR older OR geriatric OR geriatrics

Prognosis study filter and Mortality filter and Predictors filter and Age filter = Combo filter

Combo filter was then combined with the hospitalized patients filter and with the nursing home residents filter in separate searches.

Nursing home residents filter

“Nursing home” OR “nursing homes” OR “long term care” OR “extended care” OR “assisted living” OR Institutional*

Hospitalized patients filter

Title (hospital* OR ward OR wards OR “intensive care” OR ICU)

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Figure 1.
Summary of literature search and selection.

Table 1
Studies on health-related characteristics of the elderly associated with short-term mortality in multivariable analysis.

Hospitalized patients: mortality up to one year											
Reference	Country [*]	Follow-up (yrs)	Cognitive Function	Disease diagnosis	Laboratory values	Nutrition	Physical Function	Pressure Sores			
Alarcon et al. ¹⁵ 1999 N=353	ESP	1/2				Malnutrition	Barthel Index <65 on admission	Pressure sores			
Buurman et al. ¹⁶ 2008 N=463	NLD	1/4		Malignancy, Charlson comorbidity index	Blood urea nitrogen		Barthel index				
Covinsky et al. ¹⁷ 1997 N=823	USA	1					Dependent in 4 activities of daily living on admission				
Desai et al. ¹⁸ 2002 N=524	USA	1		Lymphoma/leukemia, acute renal failure, metastatic cancer, local cancer, congestive heart failure/cardiomyopathy, chronic obstructive pulmonary disease/chronic lung disease, chronic renal failure							
Drame et al. ¹² 2008 N=1,306	FRA	6/52	Delirium (DSM-IV)			Mini-Nutritional Assessment Short Form <12	Severely or moderately dependent on Katz's Activities of Daily Living Scale				
Eeles et al. ¹⁹ 2010 N=278	GBR	1	Delirium								
Flodin et al. ¹¹ 2000 N=552	SWE	1				Body mass index	Katz activities of daily living index				
Gonzalez et al. ²⁰ 2009 N=542	CHL	1/4	Delirium	Charlson Comorbidity Index							
Inouye et al. ²¹ 2003 N=1,246	USA	1	Dementia diagnosis		Creatinine>1.5, hematocrit <30	Albumin 3.5	Walking impairment at baseline				
Narain et al. ¹³ 1988 N=396	USA	1/2	Mental Status Questionnaire <9	Major admitting diagnosis			Dependent in 2 activities of daily living				
Pilotto et al. ²² 2008 N=857	ITA	1	Short Portable Mental Status Questionnaire	Cumulative Illness Rating Score		Mini-Nutritional Assessment	Activities of Daily Living score, Independent Activities of Daily Living score	Exton-Smith Scale			

Hospitalized patients: mortality up to one year									
Reference	Country*	Follow-up (yrs)	Cognitive Function	Disease diagnosis	Laboratory values	Nutrition	Physical Function	Pressure Sores	
Pitkala et al. ²³ 2005 N=425	FIN	1	Delirium (DSM-IV)						
Walter et al. ⁹ 2001 N=1,495	USA	1		Metastatic cancer, solitary cancer, congestive heart failure	Creatinine 1.5	Albumin <3 or 3.3-4	Dependent in all activities of daily living or 1-4 activities of daily living		

Hospitalized patients: in-hospital mortality									
Reference	Country*	Cognitive function	Disease diagnosis	Laboratory values	Nutrition	Physical function	Pressure sores		
Abizanda et al. ²⁴ 2007 N=356	ESP					Upper extremity function			
Agarwal et al. ²⁵ 1988 N=80	USA				Albumin<3				
Alarcon et al. ¹⁵ 1999 N=353	ESP					Barthel index <65 on admission, Red Cross Hospital Functional Disability Scale >3 before admission			
Covinsky et al. ¹⁷ 1997 N=823	USA					Dependent in 4 activities of daily living on admission			
Eeles et al. ¹⁹ 2010 N=278	GBR	Delirium							
Incalzi et al. ²⁶ 1992 N=308	ITA	Mini-Mental State Exam <24				Dependent in 1 activity of daily living			
Incalzi et al. ^{27 †} 1996 N=302	ITA				Subjective Nutritional Assessment score <2, albumin <3.5	Dependent in 1 activity of daily living			
Incalzi et al. ^{28 †} 1997 N=370	ITA		Comorbidity Index >5	Lymphocyte count <1000/mm ³	Malnutrition	Dependent in 1 activity of daily living prior to admission			
Jonsson et al. ²⁹ 2008 N=749	ISL		Admission secondary to new problem and exacerbation of an old problem						

Hospitalized patients: in-hospital mortality									
Reference	Country *	Cognitive function	Disease diagnosis	Laboratory values	Nutrition	Physical function	Pressure sores		
Marengoni et al. ^{10‡} 2003 N=923	ITA	Mini-Mental State Exam <24	Geriatrics Index of Comorbidity >2		Albumin <2.8				
Marengoni et al. ^{30‡} 2008 N=596	ITA	Mini-Mental State Exam <24	Geriatrics Index of Comorbidity	Lymphocyte count <1.17					
Pompei et al. ³¹ 1994 N=323	USA	Delirium							
Ponzetto et al. ³² 2003 N=987	ITA		Cancer, cerebrovascular disease	Creatinine<3 or 1.5–3, fibrinogen >452	Albumin <3 or 3–3.4	Dependent based on Dependence Medical Index, dependent in 1 activity of daily living			
Sampson et al. ³³ 2009 N=617	GBR	Mini-Mental State Exam <16, dementia (DSM-IV criteria)							
Sonnenblick et al. ¹⁴ 2007 N=779	ISR		APACHE II score, mechanical ventilation		Albumin				
Terzian et al. ³⁴ 1994 N=4,123	USA		>3 diagnoses	Sodium level <130 mmol/L					
Zafirir et al. ³⁵ 2010 N=333	ISR		Malignancy, acute infectious disease, atrial fibrillation	C. difficile toxin			Pressure sores		
Zekry et al. ³⁶ 2010 N=444	CHE		Geriatrics Index of Comorbidity class 3, Index of Coexistent Diseases class 4						

General nursing home residents: mortality up to one year						
Reference	Country *	Follow-up (yrs)	Cognitive function	Disease diagnosis	Nutrition	Physical Function
Barca et al. ³⁷ 2010 N=902	NOR	1		Cancer, general medical health, depression (Cornell scale)		Physical self-maintenance scale
Flacker et al. ³⁸ 1998 N=780	USA	1		Congestive heart failure	Body mass index 22, weight loss [†] , swallowing problems	Functional ability score >4
Flacker et al. ³⁹ 2003 N=15,068	USA	1		Congestive heart failure, diabetes mellitus	Weight loss [†] , >25% food uneaten, body mass index 23	Functional ability score above cohort median

Nursing home residents with advanced dementia: mortality up to one year								
Reference	Country*	Follow-up (yrs)	Cognitive function	Disease diagnosis	Nutrition	Physical Function	Pressure sores	Shortness of breath
Mitchell et al. ⁴⁰ 2004 N=4,631	USA	1/2		Cancer, congestive heart failure	<25% of food uneaten	Activities of daily living scale = 28 [†] , bowel incontinence, bedfast, not awake most of the day		Oxygen therapy needed in prior 14 days, shortness of breath
Mitchell et al. ⁴¹ 2010 N=222,405	USA	1		Congestive heart failure	Insufficient oral intake, body mass index <18.5, weight loss [‡]	Activities of daily living score = 28 [†] , bedfast most of the day, bowel incontinence	Pressure ulcer stage 2	Shortness of breath

* ESP=Spain, NLD=Netherlands, USA=United States of America, FRA=France, GBR=Great Britain, SWE=Sweden, CHL=Chile, ITA=Italy, FIN=Finland

* ESP=Spain, USA=United States of America, GBR=Great Britain, ITA=Italy, ISL=Iceland, ISR=Israel, CHE=Switzerland

^{†,‡}These pairs of studies appear to have used the same study population for their respective analyses; for our descriptive summary in Table 2, Incalzi et al. 1997 was chosen because it evaluated a greater number of domains, and Marengoni et al. 2003 was chosen because it more thoroughly evaluated physical functional measures.

* NOR=Norway, USA=United States of America

[†] >5 pounds in the previous 30 days or >10 pounds in the previous 180 days.

* USA=United States of America

[†] Represents complete functional dependence.

[‡] >5 pounds in the previous 30 days or >10 pounds in the previous 180 days.

Table 2

Frequencies across studies with which patient-related health characteristics corresponding to each domain were associated with mortality in multivariable analysis.

<i>Hospitalized patients: mortality up to one year</i>		<i>Hospitalized patients: in-hospital mortality</i>	
	Frequency of association with mortality (%)		Frequency of association with mortality (%)
Cognitive function	7/14 (50)	Cognitive function	6/12 (50)
Disease diagnosis	15/43 (35)	Disease diagnosis	13/36 (36)
Laboratory values	4/8 (50)	Laboratory values	5/20 (25)
Nutrition	6/7 (86)	Nutrition	5/11 (45)
Physical function	10/15 (67)	Physical function	8/13 (62)
Pressure sores	2/4 (50)	Pressure sores	1/1 (100)

<i>General nursing home residents: mortality up to one year</i>		<i>Nursing home residents with advanced dementia: mortality up to one year</i>	
	Frequency of association with mortality (%)		Frequency of association with mortality (%)
Cognitive function	0/7 (0)	Cognitive function	0/5 (0)
Disease diagnosis	6/12 (50)	Disease diagnosis	3/30 (10)
Nutrition	6/6 (100)	Nutrition	4/9 (44)
Physical function	3/3 (100)	Physical function	7/11 (64)
Pressure sores	0/2 (0)	Pressure sores	1/2 (50)
Shortness of breath	2/2 (100)	Shortness of breath	3/3 (100)